CLAIMS

1. A method for separating and recovering oxygen-rich air from the air, comprising:

providing a gas separation membrane module where

(i) a laminate comprising a permeate-side spacer for forming a permeate gas channel communicated with a hollow section in a core tube for collecting and discharging a permeate gas and two flat-film gas separation membranes sandwiching the spacer and

(ii) a feed-side spacer for forming a feed gas channel

are spirally wound around the core tube such that the laminate and the feed-side spacer are alternately superimposed,

vacuuming the hollow section of the core tube to 95 kPaA or less by vacuuming means while feeding the air into the feed gas channel by air feed means such that a maximum feed-air flow rate and a maximum static pressure divided by an effective membrane area of the gas separation membrane are 100 $m^3/min \cdot m^2$ or less and 4000 Pa/m^2 or less, respectively, to separate and recover oxygen-rich air from the hollow section of the core tube.

2. The method as claimed in Claim 1, wherein the gas separation membrane module has a plurality of laminates; each of the laminates comprising a permeate-side spacer for forming a permeate gas channel communicated with a hollow section in a core tube for collecting and discharging a permeate gas and two flat-film gas separation membranes sandwiching the spacer; wherein the laminates are spirally wound around the core tubes together with feed-side spacers for forming feed gas channel such

that the laminates and the feed-side spacers are alternately superimposed.

3. The method as claimed in Claim 1 or 2, wherein in the gas separation membrane module, a thickness ratio of the permeate-side spacer to the feed-side spacer is 1:2 to 1:10.

4. An apparatus for separating and recovering oxygen-rich air, comprising:

(a) a gas separation membrane module where

(i) a laminate comprising a permeate-side spacer for forming a permeate gas channel communicated with a hollow section in a core tube for collecting and discharging a permeate gas and two flat-film gas separation membranes sandwiching the spacer and

(ii) a feed-side spacer for forming a feed gas channel

are spirally wound around the core tube such that the laminate and the feed-side spacer are alternately superimposed,

(b) air feed means for feeding the air into the feed gas channel such that a maximum feed-air flow rate and a maximum static pressure divided by an effective membrane area of the gas separation membrane are 100 $m^3/min \cdot m^2$ or less and 4000 Pa/m^2 or less, respectively; and

(c) vacuuming means whereby the hollow section of the core tube is vacuumed to 95 kPaA or less to separate and recover oxygen-rich air from the hollow section of the core tube.

5. The apparatus as claimed in Claim 4, wherein the gas separation membrane module has a plurality of laminates; each of the laminates

comprising a permeate-side spacer for forming a permeate gas channel communicated with a hollow section in a core tube for collecting and discharging a permeate gas and two flat-film gas separation membranes sandwiching the spacer; wherein the laminates are spirally wound around the core tubes together with feed-side spacers for forming feed gas channel such that the laminates and the feed-side spacers are alternately superimposed.

6. The method as claimed in Claim 4 or 5, wherein in the gas separation membrane module, a thickness ratio of the permeate-side spacer to the feed-side spacer is 1:2 to 1:10.

7. A gas separation membrane module, comprising:

a plurality of laminates; each of the laminates comprising a permeate-side spacer for forming a permeate gas channel communicated with a hollow section in a core tube for collecting and discharging a permeate gas and two flat-film gas separation membranes sandwiching the spacer; wherein the laminates are spirally wound around the core tubes together with feed-side spacers for forming feed gas channel such that the laminates and the feed-side spacers are alternately superimposed,

wherein a thickness ratio of the permeate-side spacer to the feed-side spacer is 1:2 to 1:10, and

whereby the module separates and recovers oxygen-rich air from a hollow section by vacuuming the hollow section while feeding the air to a feed gas channel.